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COMPARISON OF LEVOBUPIVACAINE VS. LEVOBUPIVACAINE WITH DEXAMETHASONE IN SUPRACLAVICULAR BLOCK: ONSET, DURATION, HEMODYNAMICS, AND ANALGESIA

Anaesthesiology

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ABSTRACT

Introduction: Brachial plexus block is essential in upper limb surgeries, offering optimal surgical conditions through effective sensory and motor relaxation while maintaining hemodynamic stability. Levobupivacaine, a long-acting local anesthetic, is preferred for its reduced cardiovascular toxicity compared to bupivacaine. The addition of dexamethasone is known to prolong the effects of local anesthetics, enhancing postoperative analgesia and reducing the need for higher doses. **Materials & Methods:** A quasi-experimental study was conducted at Heritage Institute of Medical Sciences, Varanasi, from November 2022 to May 2024. Sixty patients were alternately assigned to two groups: Group A received 30 mL of 0.25% Levobupivacaine with 4 mg dexamethasone, and Group B received 30 mL of 0.25% Levobupivacaine with normal saline. Sensory and motor blockades were evaluated at specified intervals, and postoperative analgesia was assessed using the Visual Analog Scale. **Results:** Demographic characteristics and surgery duration were comparable between the groups. The Levobupivacaine + Dexamethasone group showed more stable systolic blood pressure, quicker onset, and prolonged sensory block. Additionally, this group required less postoperative Tramadol, indicating enhanced and prolonged analgesic effects. **Conclusion:** The addition of dexamethasone to Levobupivacaine provided superior sensory block and prolonged analgesia without affecting demographic characteristics or surgery duration, highlighting its value as an adjuvant in regional anesthesia for upper limb surgeries.

KEYWORDS

Levobupivacaine; Dexamethasone; Brachial plexus block; Supraclavicular block; Postoperative analgesia.

INTRODUCTION

The brachial plexus block has become a cornerstone in upper limb surgeries, offering an effective means of achieving optimal surgical conditions through complete sensory and motor relaxation. [1] This technique is particularly valued for its ability to maintain hemodynamic stability, preserve cognitive functions in elderly patients, and reduce the risks associated with general anesthesia, such as aspiration and difficult intubation. [2] Among the various techniques for administering a brachial plexus block, the supraclavicular approach stands out for its safety and efficacy, especially when performed under ultrasound guidance, which has been shown to improve the success rates of sensory and motor blockade. [3] Levobupivacaine, a long-acting local anesthetic, is widely used for regional blocks due to its favorable safety profile compared to bupivacaine. As the S(-) enantiomer of bupivacaine, Levobupivacaine offers comparable efficacy with reduced cardiovascular and central nervous system toxicity. [4,5] However, increasing the dosage of local anesthetics like Levobupivacaine can elevate the risk of systemic toxicity. To enhance the duration of analgesia and minimize the need for higher doses, adjuvants such as dexamethasone are often used.[6,7,8] Dexamethasone, known for its anti-inflammatory properties, has been shown to prolong the effects of local anesthetics, thereby improving postoperative pain management. [9,10,11]

This study aimed to compare the onset and duration of sensory and motor blockade when using Levobupivacaine alone versus Levobupivacaine combined with dexamethasone in a supraclavicular block for forearm surgeries. Additionally, the research evaluated the impact on hemodynamic parameters and the duration until the first rescue analgesia was needed. By exploring these factors, the study sought to determine whether the combination of Levobupivacaine with dexamethasone provided superior anesthesia and postoperative analgesia while maintaining safety and reducing potential complications.

MATERIALS & METHODS

This quasi-experimental study was conducted in the Department of Anaesthesiology at Heritage Institute of Medical Sciences, Varanasi, from November 2022 to May 2024. Sixty patients, aged 18 to 60 years, with ASA I-II status and weighing at least 50 kg, were included. Patients were alternately assigned to Group A or Group B, with 30 patients in each group. Group A received 30 mL of 0.25% Levobupivacaine with 4 mg dexamethasone, while Group B received 30 mL of 0.25% Levobupivacaine with 1 mL normal saline.

All patients fasted for six hours preoperatively. Upon arrival in the operating room, standard monitoring, including electrocardiogram, non-invasive blood pressure, and pulse oximetry, was initiated, and baseline parameters were recorded. An 18G intravenous line was secured on the opposite limb, and crystalloid infusion was started. The brachial plexus block was performed under aseptic conditions using a supraclavicular approach with ultrasound guidance.

Sensory and motor blockades were assessed at specified intervals post-injection, with the onset of sensory block evaluated every minute for 20 minutes and motor block every five minutes. Postoperative analgesia duration was measured using the Visual Analog Scale (VAS) at 3, 6, 12, and 24 hours. Rescue analgesia with 100 mg of Tramadol was administered when the VAS score reached 4.

Statistical analysis was performed using SPSS version 20, with descriptive statistics and appropriate tests applied to compare outcomes between the groups. A p-value of ≤0.05 was considered statistically significant.

RESULTS

Table 1 compares the demographic characteristics (age, weight, and height) between two groups: patients receiving Levobupivacaine alone and those receiving Levobupivacaine with dexamethasone. The mean age, weight, and height are slightly different between the groups, but the differences are not statistically significant (p-values > 0.05), indicating that the groups were comparable in these parameters.

Parameter	Group	Mean	SD	Min	Max	Median	p-value	T Statistic
Age (years)	Levobupivacaine	54.60	15.77	28.00	80.00	60.00	0.2670	1.1229
	Levobupivacaine + Dexamethasone	49.04	19.08	25.00	84.00	45.00		
Weight (kg)	Levobupivacaine	66.48	9.79	48.00	88.00		0.7539	0.3153
	Levobupivacaine + Dexamethasone	67.48	12.47	40.00	89.00			
Height (cm)	Levobupivacaine	160.36	6.83	148.0	170.0		0.4228	0.8085
	Levobupivacaine + Dexamethasone	158.44	9.71	140.0	176.0			

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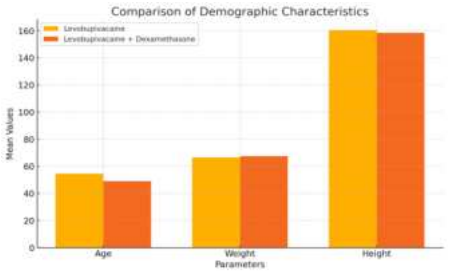


Table 2 presents the mean duration of surgery in minutes for two groups: Levobupivacaine and Levobupivacaine with dexamethasone. The mean duration was slightly longer in the Levobupivacaine group (85 minutes) compared to the Levobupivacaine + Dexamethasone group (83 minutes). However, the difference was not statistically significant (p-value > 0.05), indicating that the duration of surgery was comparable between the two groups.

Parameter	Group	Mean	SD	Minimum	Maximum	p-value	T Statistic
Duration of Surgery (mins)	Levobupivacaine	85.00	12.05	70.00	120.00	0.164303	1.395917
	Levobupivacaine + Dexamethasone	83.00	8.02	70.00	100.00		

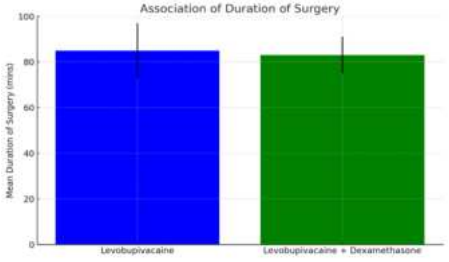


Table 3 shows that the Levobupivacaine group had a higher mean systolic blood pressure (SBP) with greater variability compared to the group receiving Levobupivacaine with dexamethasone. However, mean values for diastolic blood pressure (DBP), heart rate (HR), and SpO2 were similar between the two groups.

Parameter	Group	Mean	SD	Minimum	Maximum	p-value	T Statistic
SBP (mmHg)	Levobupivacaine	169.52	199.14	120.00	1124.00	0.03039	1.0392
	Levobupivacaine + Dexamethasone	128.08	9.76	110.00	152.00		
DBP (mmHg)	Levobupivacaine	80.64	9.59	60.00	90.00	0.1593	1.2296
	Levobupivacaine + Dexamethasone	76.88	9.00	62.00	90.00		
HR (beats/min)	Levobupivacaine	81.32	9.60	60.00	99.00	0.8436	0.1983
	Levobupivacaine + Dexamethasone	80.72	11.69	64.00	100.00		
SpO2 (%)	Levobupivacaine	97.28	1.17	92.00	99.00	0.7171	0.3645
	Levobupivacaine + Dexamethasone	97.40	1.15	95.00	99.00		

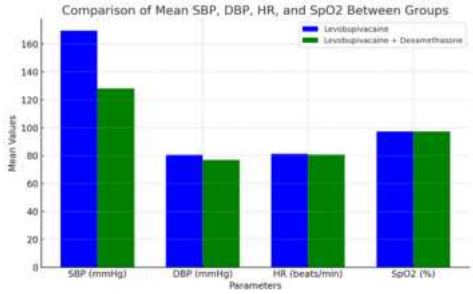


Table 4 shows the count and percentage of patients in each sensory grade (0, 1, and 2) for both the median and ulnar nerves at the beginning (1 minute) and after 20 minutes, comparing the Levobupivacaine alone group with the Levobupivacaine + Dexamethasone group.

Time (mins)	Nerve	Group	Grade 0 (Count, %)	Grade 1 (Count, %)	Grade 2 (Count, %)
1 min	Median	Levobupivacaine + Dexamethasone	19 (63.3%)	9 (30.0%)	2 (6.7%)
		Levobupivacaine	21 (70.0%)	8 (26.7%)	1 (3.3%)
20 mins	Median	Levobupivacaine + Dexamethasone	1 (3.3%)	3 (10.0%)	26 (86.7%)
		Levobupivacaine	1 (3.3%)	6 (20.0%)	23 (76.7%)
1 min	Ulnar	Levobupivacaine + Dexamethasone	20 (66.7%)	8 (26.7%)	2 (6.7%)
		Levobupivacaine	23 (76.7%)	7 (23.3%)	0 (0.0%)
20 mins	Ulnar	Levobupivacaine + Dexamethasone	1 (3.3%)	2 (6.7%)	27 (90.0%)
		Levobupivacaine	2 (6.7%)	6 (20.0%)	22 (73.3%)

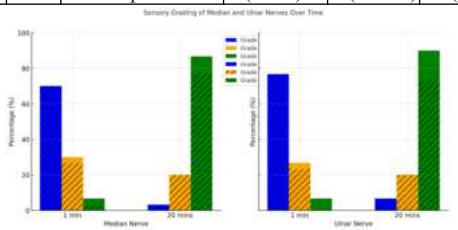
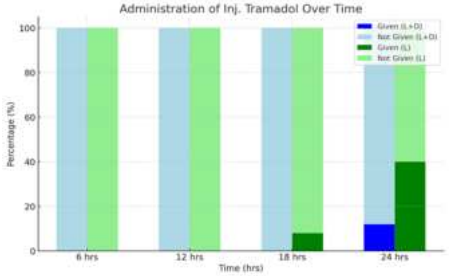


Table 5 compares the administration of Inj. Tramadol across different time intervals for Group L+D and Group L. In Group L+D, Inj. Tramadol was not required until the 24-hour mark, where 2 patients (12%) received it. In contrast, Group L showed an increasing need for Inj. Tramadol, with 2 patients (8%) at 18 hours and 10 patients (40%) at 24 hours, indicating a higher analgesia requirement over time.

Time (hrs)	Group	Given (Count, %)	Not Given (Count, %)
6 hrs	L+D	0 (0%)	30 (100%)
	L	0 (0%)	30 (100%)
12 hrs	L+D	0 (0%)	30 (100%)
	L	0 (0%)	30 (100%)
18 hrs	L+D	0 (0%)	30 (100%)
	L	2 (8%)	28 (92%)
24 hrs	L+D	2 (12%)	28 (88%)
	L	10 (40%)	20 (60%)



DISCUSSION

The study found that the demographic characteristics, including age, weight, and height, were comparable between the two groups receiving Levobupivacaine alone and Levobupivacaine with dexamethasone, with no statistically significant differences (p-values > 0.05). The mean duration of surgery was slightly longer in the Levobupivacaine group (85 minutes) compared to the Levobupivacaine + Dexamethasone group (83 minutes), though this difference was not statistically significant (p-value = 0.164). Hemodynamic parameters revealed that the Levobupivacaine group had a higher and more variable systolic blood pressure (SBP) compared to the Levobupivacaine + Dexamethasone group (mean SBP 169.52 mmHg vs. 128.08 mmHg, p-value = 0.030). However, diastolic blood pressure (DBP), heart rate (HR), and oxygen saturation (SpO2) were similar between the groups, indicating comparable hemodynamic stability.

In terms of sensory block, at 20 minutes, a higher percentage of

patients in the Levobupivacaine + Dexamethasone group achieved Grade 2 sensory block for both the median and ulnar nerves compared to the Levobupivacaine group, suggesting that the addition of dexamethasone enhanced the sensory block. Additionally, the requirement for rescue analgesia with Inj. Tramadol was lower in the Levobupivacaine + Dexamethasone group, with only 12% of patients requiring analgesia at 24 hours compared to 40% in the Levobupivacaine group, indicating prolonged analgesic effects.

These findings are consistent with previous studies. **Persec et al. [12] (2013)** observed a more pronounced effect of dexamethasone on prolonging analgesia in their study, where the mean duration of analgesia in the dexamethasone group exceeded 12 hours compared to just under 8 hours in the control group. Although the present study did not specifically measure the exact duration of analgesia, the reduced need for Inj. Tramadol in the Levobupivacaine + Dexamethasone group at 24 hours is consistent with these findings, indicating a prolonged effect. **Baloda et al. [13] (2016)** found that the addition of dexamethasone significantly reduced the need for postoperative analgesia, with only 10% of patients in the dexamethasone group requiring rescue analgesia within 24 hours, compared to 25% in the control group. **Hanumansetty et al. [14] (2017)** also reported that dexamethasone stabilized SBP more effectively when added to Levobupivacaine. These studies collectively support the present study's findings that dexamethasone enhances sensory block, prolongs analgesia, and stabilizes hemodynamic parameters, making it a valuable adjuvant in regional anesthesia. **Pani et al. [15] (2017)** demonstrated that adding dexamethasone to Levobupivacaine significantly prolonged the duration of sensory and motor blockades, with the dexamethasone group having a longer sensory blockade duration of 8.02 hours compared to 5.32 hours in the control group.

Nadeem et al. [16] (2017) found that the addition of dexamethasone to both Levobupivacaine and Bupivacaine provided enhanced sensory and motor blockades in supraclavicular blocks. Their study reported that 90% of patients in the dexamethasone group achieved a complete sensory block at 30 minutes, compared to 70% in the control group. This aligns with the present study's findings, where a higher percentage of patients in the Levobupivacaine + Dexamethasone group achieved Grade 2 sensory block at 20 minutes for both the median and ulnar nerves

CONCLUSION

The study concluded that the addition of dexamethasone to Levobupivacaine did not significantly alter demographic characteristics or the duration of surgery between the groups. However, the Levobupivacaine + Dexamethasone group showed more stable systolic blood pressure and better sensory block at 20 minutes. This group also required less postoperative analgesia, with fewer patients needing Inj. Tramadol, suggesting enhanced and prolonged analgesic effects with the combined therapy.

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